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Grid stiffened tank structures such as Ortho-Grid and Iso-Grid are widely used in cryogenic tanks for providing stiffening to the tank while reducing mass, compared to tank walls of constant cross-section. If the structure is internal to the tank, it will positively affect the fluid dynamic behavior of the liquid propellant, in regard to fluid slosh damping. As NASA and commercial companies endeavor to explore the solar system, vehicles will by necessity become more mass efficient, and design margin will be reduced where possible. Therefore, if the damping characteristics of the Ortho-Grid and Iso-Grid structure is understood, their positive damping effect can be taken into account in the systems design process.

Historically, damping by internal structures has been characterized by rules of thumb and for Ortho-Grid, empirical design tools intended for slosh baffles of much larger cross-section have been used. There is little or no information available to characterize the slosh behavior of Iso-Grid internal structure. Therefore, to take advantage of these structures for their positive damping effects, there is much need for obtaining additional data and tools to characterize them.

Recently, the NASA Marshall Space Flight Center conducted both sub-scale testing and computational fluid dynamics (CFD) simulations of slosh damping for Ortho-Grid and Iso-Grid tanks for cylindrical tanks containing water. Enhanced grid meshing techniques were applied to the geometrically detailed and complex Ortho-Grid and Iso-Grid structures. The Loci-STREAM CFD program with the Volume of Fluid Method module for tracking and locating the water-air fluid interface was used to conduct the simulations. The CFD simulations were validated with the test data and new empirical models for predicting damping and frequency of Ortho-Grid and Iso-Grid structures were generated.

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